

Seat with a separately adjustable back rest and seat portion and an adjustable seat depth.

The present invention relates to a seat of the type comprising a seat portion and a back rest, hinged to one another about an axis of rotation.

More specifically, the present invention relates to a seat of the abovementioned type in which said hinging is achieved in the form of a pair of means located on either side of the seat about a plane of symmetry passing through the back rest and the seat portion, each of said means consisting of, on the one hand, a first element, forming a back rest rotation support, through which said axis of rotation passes and one end of which is integral with said back rest, and, on the other hand, a second element.

A seat meeting this definition is known from US patent application US2003/0011226 A1. It consists of a car seat comprising an inverted U-shaped part as a back rest structure 14 and a frame as a seat portion structure 10, said frame being mounted so as to slide on a support 86. Each free end of the U-shaped part constitutes what was referred to above as a first element, and the second element of the hinge system is a part integral with the frame 10, in such a way that the second element is the seat portion frame itself. The ends of the U-shaped part are inserted in a slot made in the seat portion frame 10 in such a way that, when the seat portion structure slides, the back rest structure can only follow.

No means are provided for adjusting the depth of the seat portion and any such adjustment is entirely impossible owing to the fact that the back rest structure is inserted in the seat portion structure.

However, an important factor in the user's comfort is that the depth of the seat portion be adapted to his size. For example, it is just as uncomfortable for a tall person whose thighs jut out to some extent over the front of the seat portion as for a short person whose legs do not touch the floor when he is sitting back in the seat.

The invention proposes a novel solution to this problem by combining the hinging of the back rest/seat with the adjustment of the depth of the seat portion.

To this end, the invention relates to a seat of the 5 abovementioned type, characterized in that said second element is a part which is

- separate from the seat portion,
- integral with said first element via said axis of rotation which passes through said second element near 10 one of its ends and said first element,
- mounted so as to be able to slide on a part integral with the seat portion and
- immobilizable in a desired position with respect to this same part,

15 a first extendable/retractable member being fastened, on the one hand, to the end of said first element opposite the end which is integral with the back rest and, on the other hand, to the end of said second element which is opposite the axis of rotation.

20 By virtue of this arrangement, as will be explained below, the back rest rotation support can be moved in translation with respect to the seat portion.

In a preferred embodiment, the first extendable/retractable member is a gas spring, i.e. an 25 element with a hydro-pneumatic structure having a cylinder and a piston, making it possible to pivot the back rest and counterbalance the movement at a controlled speed, simply under the effect of the user's upper torso pressing on the back rest.

30 Since the force of the user's pressing depends on the latter's weight, it is thus convenient to be able to adjust the gas spring.

To this end, its point of fastening to said back rest rotation support is adjustable along said support.

35 Thus, the length of travel of the gas spring piston and, hence, its resistance can be set as desired.

The seat portion sliding support advantageously comprises a stop limiting the pivoting of the back rest with respect to the seat portion.

As stated above, the seat portion sliding support 5 slides with respect to a part integral with the seat portion and is immobilizable with respect to this same part. The back rest rotation support and the seat portion sliding support are integral via the axis of rotation, and therefore the back rest rotation support also slides with 10 respect to the part integral with the seat portion and, as a result, the distance between the back rest and the free edge of the seat portion can be adjusted (in other words, the depth of the seat portion can be adjusted).

In adjustable seats, such as the seats in motor 15 vehicles and airplanes, the backrest may be adjusted with respect to the general plane of the seat portion, which itself remains fixed. Seats are also known in which the rearward adjustment of the back rest causes the seat portion to tilt upward, and vice versa.

20 For improved comfort, it would however be desirable if, in the same seat, not only the angle between the back rest and the seat portion could be modified at will but also if the angle between the general plane of the seat portion and the floor could also be modified, and if these 25 two modifications could be independent of one another.

To this end, the seat according to the invention also comprises a seat portion support that rests directly or indirectly on the floor and this seat portion support has a point of fastening for one of the ends of a second 30 extendable/retractable member whose other end is fastened to the seat portion.

This second extendable/retractable member may be a pneumatic jack or an electric jack.

It is thus possible to tilt the back rest and the 35 seat portion independently of one another.

In a preferred embodiment of the invention, the seat is a relaxation armchair and, to this end, it also comprises a leg rest.

Since it is important, here again, that the leg rest 5 can be operated independently of the adjustment of the back rest and of the adjustment of the seat portion, said leg rest has a point of fastening for one of the ends of a third extendable/retractable member whose other end is fastened to the seat portion.

10 This third extendable/retractable member may be a pneumatic jack or an electric jack.

Thus, the first, second and third extendable/retractable members function independently of one another.

15 A better understanding of the invention will be obtained from reading the following description provided with reference to the attached drawings, in which:

- figures 1a-1c schematically show the respective planes of the three main components (seat portion, back 20 rest and leg rest) of a relaxation armchair according to the invention and figures 1d-1f schematically show three possible depths of the seat portion according to the invention;

- figure 2 is a schematic view of the installation of 25 the three extendable/retractable control members;

- figure 3 is a detail view of the region of hinging between the back rest and the seat portion and

- figure 4 is a detail view of the hinge system of 30 figure 3, seen from the rear of the seat (arrow F in figure 3).

Referring to figures 1a-1c, these show the positions occupied by the planes of the seat 1, back rest 2 and leg rest 3, in the "sitting" position (figure 1a), relaxation position (figure 1b) and "zero gravity" position (heart 35 lower than leg rest) (figure 1c), respectively.

The seat portion 1 makes, with the back rest 2, an angle  $\alpha$  which is variable ( $\alpha_1 < \alpha_2 < \alpha_3$ ) and, with the leg

rest 3, an angle  $\beta$  which is also variable ( $\beta_1 < \beta_2 < \beta_3$ ), and  $\alpha$  varies independently of  $\beta$ .

The three planes (plane of the seat portion 1, plane of the back rest 2 and plane of the leg rest 3) can be  
5 moved independently of one another.

To this end, as shown by figure 2, three operating members are provided.

More specifically, the seat portion 1 is adjusted with respect to the floor using a pneumatic jack 4 which  
10 bears, on the one hand, on said seat portion 1 and, on the other hand, on a seat portion support 5 resting on the floor; the back rest 2 is adjusted with respect to the seat portion 1 using a gas spring 6 which bears, on the one hand, on said seat portion 1 and, on the other hand, on a  
15 part 10 attached to the back rest 2; and the leg rest 3 is tilted with respect to the seat portion 1 using a pneumatic jack 7 which bears, on the one hand, on said seat portion 1 and, on the other hand, on said leg rest. The gas spring 6 is actuated, in one direction, simply by the user's upper  
20 torso pressing against the back rest 2 and, in the other direction, simply by the user raising his back off the back rest and, if necessary, bearing on the arm rests (not shown). Note that the back rest 2 returns automatically since, when the user reclines by pressing with his upper  
25 torso, the gas in the gas spring is compressed and, once the pressure is released, the gas expands. The pneumatic jacks 4 and 7 are actuated, entirely conventionally, by a push button. The pneumatic jacks 4 and 7 could be replaced by electric jacks, keeping the gas spring 6 for operating  
30 the back rest 2, or alternatively the gas spring 6 could itself also be replaced by an electric jack.

Note that the seat portion 1 pivots about the point P. The seat portion support 5 has heightwise-adjustable legs.

35 The leg rest 3 incorporated in the armchair according to the invention may have the structure described in EP 1 099 396, i.e. an extendable and retractable structure,

with little wheels in permanent contact with the floor; thanks to these little wheels, extension only has to be initiated, most of the extension movement taking place simply under the effect of gravity.

5 Referring to figure 3, this shows in detail the region of hinging between the seat portion 1 and the back rest 2, on one of the side faces of the seat, a symmetrical assembly being located on the other side face. The reference 8 denotes a part integral with the back rest and  
10 the reference 9 denotes a part integral with the seat portion. The hinge system comprises a first element 10, the "back rest rotation support", and a second element 11, the "seat portion sliding support", the elements 10 and 11 being joined by an axis of rotation 12.

15 As can be seen, the element 10 has roughly the shape of a bicorn hat, lying vertically, with the axis of rotation 12 passing through it approximately at its center. At one of its ends, the element 10 is assembled fixedly to the part 8 integral with the back rest and, at its other  
20 end, the element 10 has a point of fastening 13 for the rod 14 of the piston of the gas spring 6 whose cylinder 15 is fastened at 16 to the second element 11. An adjustment screw 17 is provided for moving the point of fastening 13 and hence increasing or reducing the length of travel of  
25 the piston of the gas spring 6.

A stop 18 limits the pivoting of the element 10 and hence of the back rest 2.

As can be seen more clearly in figure 4, the element 11 comprises adjustment holes such as 19, which face slots  
30 such as 20 made in the part 9, in such a way that the relative position of the element 11 and of the part 9 can be modified in translation by sliding and fixed in the desired position by screwing in bolts, such as 21, which pass through both a hole 19 and a slot 20.

35 This assembly thus makes it possible to regulate both the control of the reclining of the back rest as a function of the weight of the user (by adjusting the level of the

point of fastening 13) and that of the depth of the seat portion (by adjusting the relative position of the element 11 and of the part 9).

The result of adjusting the depth of the seat portion  
5 is shown schematically by figures 1d-1f. Figure 1d is identical to figure 1a and shows a maximum seat portion depth  $P_1$ , the base of the back rest 2 adjoining the rear edge of the seat portion 1. Figure 1e shows a shorter seat portion depth  $P_2 < P_1$  due to relative movement between the  
10 back rest 2 and the seat portion 1, the angles  $\alpha_1$  and  $\beta_1$  remaining the same, and figure 1f shows an even shorter seat portion depth  $P_3 < P_2 < P_1$  due to relative movement between the back rest 2 and the seat portion 1, the angles  $\alpha_1$  and  $\beta_1$  always remaining the same. Note that the three positions  
15 illustrated are merely three examples, any intermediate position being possible, and that it is possible to modify the seat portion depth whatever the angles  $\alpha$  and  $\beta$ .

Obviously, these adjustments, which require the use of tools, will generally be made on installation, depending  
20 on the person for whom the chair is intended. Thus, the same household may have two exactly identical chairs, except that one is adjusted for a short person of slight build and the other for a tall, heavy person.